

<p align="center">8 PHYSICAL EXAMINATION AND CLASSIFICATION OF TOOLMARKS</p>	<p align="center">Page 1 of 5</p>
<p align="center">Division of Forensic Science</p> <p align="center">FIREARM/TOOLMARK PROCEDURES MANUAL</p>	<p align="center">Amendment Designator:</p>
	<p align="center">Effective Date: 21-April-2003</p>
<p align="center">8 PHYSICAL EXAMINATION AND CLASSIFICATION OF TOOLMARKS</p> <p>8.1 Introduction</p> <p>The basic objective in evaluating a questioned toolmark is to determine the suitability and classification of the toolmark. In order to compare a questioned toolmark with a suspect tool or another toolmark, it is necessary to conduct a physical examination and classification of the toolmark and the tool, which will help determine what course the rest of the examination should follow.</p> <p>In order to compare a questioned toolmark with a suspect tool, test standards or marks are usually made with the suspect tool. The basic objective in preparing test standards is to attempt to duplicate the manner in which the tool was used to reproduce the evidence or questioned toolmark.</p> <p>8.2 Safety Considerations</p> <p>Examinations performed in the Firearm and Toolmark Section are inherently hazardous. These procedures involve hazardous chemicals, firearms, ammunition, and power tools. All hazardous procedures must be performed in compliance with the DFS Safety Manual.</p> <p>8.3 Preparation of Cleaning Solutions</p> <p>NOTE: ALWAYS ADD ACID TO WATER. NEVER ADD WATER TO ACID</p> <p>8.3.1 Acetic Acid Solution</p> <ul style="list-style-type: none"> • Prepare a 15% Acetic Acid Solution by adding 150 milliliters of Glacial Acetic Acid to 850 milliliters of distilled water • Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer • Record in the Firearms Quality Record Book <p>8.3.2 Bleach Solution</p> <ul style="list-style-type: none"> • Prepare a Bleach Solution by combining 10 milliliters of bleach to 90 milliliters of distilled water • Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer • Record in the Firearms Quality Record Book <p>8.4 Instrumentation</p> <ul style="list-style-type: none"> • Stereo Microscope • Caliper • Micrometer • Ruler or tape-measure • Scale/Balance • Diode Sputtering System (if used) <p>8.5 Minimum Analytical Standards and Controls</p> <p>Appendix - A</p>	

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<p>8.6 Procedure or Analysis</p> <p>The evidence and tests produced will be marked in accordance with the Quality Manual. The tests will be returned to the submitting agency in a sealed condition with the other submitted evidence. A laboratory worksheet utilized for a tool or toolmark examination should be filed out.</p> <p>8.6.1 General, Physical, and Trace Examinations</p> <p>The initial examination of a tool or a toolmark will include the completion of a worksheet, which will include the physical description of the tool and/or the toolmark. It will also serve as a source to document the condition of the evidence as received. Further information will be added to the worksheet as tests and comparisons are performed.</p> <p>Examine the tool and/or toolmark visually and microscopically for any trace material. Determine if further examination of trace material is necessary and consult the appropriate Section prior to the removal of any trace evidence. Document findings and observations in the notes.</p> <p>8.6.2 Trace Material Examination</p> <p>Evidence recovered during an investigation may contain trace material transferred from the crime scene. This trace material may be in the form of blood, tissue, plaster, paint, hairs, fibers, glass, etc. The examiner needs to evaluate the importance of this evidence, and if further examination of the trace material is necessary, remove and preserve a sample of the trace material present. Removal of trace material may also be necessary to allow the proper examination of the evidence.</p> <ul style="list-style-type: none"> • Remove trace material being careful not to damage the evidence • Place the removed trace material in a suitable container/packaging for possible submission to the appropriate Section for further examination • Record findings and observations in the notes <p>If the trace material IS NOT going to be retained for further examination, proceed with the following:</p> <ul style="list-style-type: none"> • For evidence containing blood, tissue, or other biohazards, soak or sonicate the evidence for at least one (1) minute in a Bleach Solution (refer to 8.3) • Remove loosened material by rinsing the tool with methanol or water • Remove plaster by soaking the tool in a 15% Acetic Acid Solution (refer 8.3) • Remove paint by soaking the tool in alcohol or acetone • Use a non abrasive brush to remove loose material <p>8.6.3 Tool Examination</p> <p>The tool examination is used to establish the following:</p> <ul style="list-style-type: none"> • Brand and type of tool. • Size and condition • Class characteristics of the tool • Areas of use on the tool • Type of tests conducted (if any) • The medium used for testing • Indexing of test standards/marks 	

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<p>8.6.4 Toolmark Examination</p> <p>The toolmark examination process is used to establish:</p> <ul style="list-style-type: none"> • The suitability of the toolmark for comparison purposes • Class of tool that made the toolmark • Type of toolmark (striated, impressed, combination) • Direction of the toolmark • If the toolmark is not suitable for comparison and does not have the same class characteristics as the suspect tool, then the toolmark can be eliminated as having produced the toolmark • If the toolmark is suitable for comparison, or the toolmark has the same class characteristics as the suspect tool, the examination should continue <p>Methods used to enhance toolmarks for further examination:</p> <ul style="list-style-type: none"> • Dusting the toolmark with fingerprint powder • Diode sputtering system, traditionally used for coating Scanning Electron Microscopy (SEM) specimens • Magnesium smoking to reduce glare on shiny surfaces by coating with magnesium smoke to enhance microscopic examination <p>WARNING! UV protective safety glasses must be worn</p> <p>Short pieces of magnesium ribbon are lit by a flame The object to be smoked is passed over the smoke generated by the burning magnesium If the object collects too much smoke, wipe the smoke off and repeat the process The coating should be light enough to see the color of the item through the coating of smoke</p> <p>Test Media:</p> <p>In order to perform a microscopic comparison of a submitted tool with a toolmark, test toolmarks must be produced with the suspect tool. The initial test media must be soft enough to prevent alterations of the tool's working surface, and lead is usually the preferred material. Additional tests might require the use of the material used in the original toolmark. Dusting, sputtering, and smoking may be applicable to the questioned toolmark tests produced, and casts.</p> <p>8.6.5 Casting</p> <p>Casting is a procedure used in a toolmark examination to make a reverse image of a tool or toolmark, which can then be used for comparative microscopic examination purposes. It may be necessary to make a cast of a tool or toolmark. If an item received for a toolmark examination is too large to be conveniently placed on the microscope's stages, a silicon rubber cast can be made of the tool or toolmarks in question. There are also occasions when a cast of a toolmark might be received as evidence. In either case, any test standards made will also have to be cast in order to perform a comparison. Mikrosil®, Duplicast®, Espe Impregum® or other types of silicon rubber casting material are similar products and procedurally are equivalent as long as the manufacturer's instructions are followed.</p> <ul style="list-style-type: none"> • Mix Mikrosil®, Duplicast®, or Espe Impregum® as per manufacturer instructions • Apply the casting material over the tool or toolmark to be cast • When casting material is set or cool, depending on type used, gently tap to loosen the cast from the tool or toolmark, and then lift to remove the cast • Mikrosil®, Duplicast®, and Espe Impregum® have to be pushed or forced away from the tool or toolmark 	

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<div data-bbox="344 352 1539 445"> <ul style="list-style-type: none"> • Consideration must be given to placing identifying marks as well as orientation marks on the back of the cast, or scribe identifying marks and/or orientation marks onto the tool or toolmark being cast • Record findings and observations in the notes </div> <div data-bbox="246 474 618 504"> <p>8.6.6 Toolmark Tests Produced</p> </div> <div data-bbox="344 533 1539 625"> <p>Toolmark tests may be produced from submitted evidence material or from laboratory stock material. These tests should be marked in accordance with the Quality Manual and returned to the submitting agency in a sealed condition with the other submitted evidence.</p> </div> <div data-bbox="246 655 613 684"> <p>8.6.7 Microscopic Comparison</p> </div> <div data-bbox="344 714 1539 777"> <p>Microscopic comparison of tools and toolmark(s) is detailed in Section 5 of the Firearm/Toolmark Procedures Manual.</p> </div> <div data-bbox="246 806 602 835"> <p>8.6.8 Interpretation of Results</p> </div> <div data-bbox="344 865 1539 1029"> <ul style="list-style-type: none"> • The toolmark(s) were identified as having been produced by same tool or with the submitted tool • The toolmark(s) were not produced by the submitted tool • It was not possible to determine whether or not the toolmarks were made by the submitted tool due to differences in class and/or individual characteristics • Record interpretation of results in the notes </div> <div data-bbox="246 1058 544 1087"> <p>8.6.9 Reporting Formats</p> </div> <div data-bbox="344 1117 660 1150"> <p>Disposition of tests produced:</p> </div> <div data-bbox="438 1180 1539 1243"> <p>Tests produced by the item __ tool are being returned with the evidence and should be maintained for possible future examinations.</p> </div> <div data-bbox="438 1272 1539 1335"> <p>Casts produced of the item __ toolmark(s) are being returned with the evidence and should be maintained for possible future examinations.</p> </div> <div data-bbox="344 1365 743 1394"> <p>Identification of a toolmark to a tool:</p> </div> <div data-bbox="438 1423 1354 1457"> <p>The item __ toolmark was identified as having been produced by the item __ hammer.</p> </div> <div data-bbox="344 1486 719 1516"> <p>Elimination of a toolmark to a tool:</p> </div> <div data-bbox="438 1545 1539 1608"> <p>Because of a difference in class and/or individual characteristics, the item __, __ or __ toolmarks could not have been produced by the item __ screwdriver.</p> </div> <div data-bbox="344 1638 855 1671"> <p>Unable to identify or eliminate toolmark to tool:</p> </div> <div data-bbox="438 1701 1539 1822"> <p>Toolmarks present on the item __ piece of wire exhibit similar class characteristics as those produced with the item __ wire cutters; however, because of the lack of sufficient suitable corresponding microscopic markings, it was not possible to determine whether or not the item __ wire cutters produced the toolmark(s) on the item __ piece of wire.</p> </div>	

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<p align="center">Identifying class characteristics of a toolmark:</p> <p align="center">The toolmarks on the item ___ safe door were made by a prying type tool with a flat bladed tip, approximately one (1) inch in width.</p> <p>8.7 Appropriate Appendices</p> <p>Appendix – Calibration Standards</p> <p>Appendix - Work Sheets</p> <p>8.8 References</p> <p>“Mikrosil Casting Material Information”. <u>AFTE Journal</u>. Vol. 15, No. 2, p. 80.</p> <p>Barber, D.C. and Cassidy, F.H. “A New Dimension with ‘Mikrosil’ Casting Material”. <u>AFTE Journal</u>. Vol. 19, No. 3, p. 328.</p> <p>DeForest, Gaensslen, and Lee. <u>Forensic Science: An Introduction to Criminalistics</u>. McGraw-Hill: New York. 1983.</p> <p>Janneli, R., and Geyer, G. “Smoking a Bullet”. <u>AFTE Journal</u>. Vol. 9, No. 2, p. 128.</p> <p align="right">◆ End</p>	